32. (Amended) Apparatus according to claim 27 and 29, wherein when using a gaseous chemical, in the filtrate line after the mixer there is arranged a separator for excess non-reacted gas.

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33. (Apparatus) Apparatus according to claim 32, wherein said gas-separator is connected to the filtrate tank wherein the separated gas and foam possibly separated with it are led.

34. (Amended) Apparatus according to claim 27, wherein the filtrate system preceding the oxygen stage comprises at least one pressurized reaction vessel.

REMARKS

Favorable reconsideration and allowance of this application are requested.

By way of the amendment instructions above, the specification has been revised so as to introduce application headings.

A proposed drawing revision to Fig. 1 so as to label the same as "prior art" is noted in RED in the attached photoprint thereof. Approval is requested.

The claim amendments presented herewith are believed to address the Examiner's rejection advanced under 35 USC §112, second paragraph. In this regard, it will be observed that the terms "a first washing stage" and "a second washing stage" have been added to claim 1 for purpose of clarity. There may of course be other washing/treatment stage(s) between the first and second washing stages, as shown in Figures 2 and 3. Withdrawal of the same is therefore solicited.

The indication of allowable subject matter is noted with appreciation by the applicants. However, as will be discussed in greater detail below, it is suggested that all claims now pending herein are allowable over the applied Maples et al reference, either alone or in combination with Smook taken with either Marcucci et al or Brahmbhatt.

The present invention especially relates to a washing process of a pulp to be oxygen delignified. In the oxygen stage carried out in medium consistency range, the amount of filtrate per one kg of pulp is 6 – 9 kg, and thus the properties of the filtrate have an essential effect on reactions which the pulp is subjected to in the oxygen stage, as also in the bleaching later on. So, the properties of the filtrate surrounding the pulp may have a significant effect on the chemical treatments carried out on pulp and also the disadvantageous reactions that the pulp is exposed to.

During the cooking, great amounts of organic material, mainly comprising lignin and carbohydrates originating from hemicellulose are detached from the wood fibers. Each of these organic materials has a chemical composition of its own as a result of the cooking conditions. When passing to the washing and the oxygen stage, these organic materials are carrying chemical compounds and end groups, which react with e.g. oxygen and peroxide. Thus, compounds practically inert in cooking conditions are reactive in new chemical conditions.

According to applicants' studies, the chemical reactions of the oxygen stage as a whole proceed essentially so that part of the oxygen reacts directly with the lignin compounds of the pulp and splits lignin by means of a direct reaction. Oxygen in itself is a selective chemical, which does not split carbohydrates. But in alkaline conditions part of the oxygen converts to peroxide which is very quickly decomposed to hydroxyl radicals by the effect of e.g. black liquor compounds originating from the cook. A hydroxyl radical is chemically very reactive, and the reactions thereof are not districted to reacting with lignin only, but it also causes splitting of carbohydrate chains of the pulp. Practice has shown that the selectivity or non-selectivity of a hydroxyl radical may be described e.g. so that a hydroxyl radical splits one cellulose molecule per five lignin molecules. In our experiments especially the presence of black liquor increased the degradation of peroxide and, accordingly, accelerated the forming of hydroxyl radicals at the end of the reaction chain, whereby a bigger portion of the oxygen changes via peroxide to hydroxyl radicals and thus causes damages to the pulp.

As the filtrate coming from the washing after the oxygen stage is already oxidized (in the oxygen stage), the treatment thereof does not significantly change the situation anymore. That is why the oxidation should, according to applicants' studies be performed before the last washing stage prior to the oxygen stage, e.g. between the last and the last but one washing stages. Oxidizing the liquid solution between the washers prevents non-oxidized filtrate from entering the oxygen stage.

Thus, the present invention is based *inter alia* on the concept that filtrate essentially related to brown stock washing and the oxygen stage connected thereto is treated with an oxidizing chemical so that the aim is to shut off the black liquor flow entering with the pulp from the cook as washing loss in such a way that as much as possible of the black liquor flow travelling with the pulp in form of washing loss has been gone through an oxidizing stage prior to entering the oxygen stage.

In applicants' view, the principle to oxidize the filtrate coming from the last washer upstream of the oxygen before the filtrate is recycled countercurrently and used as a washing liquid in a preceding washer is defined in claims 1 and 27. This method is not known or obvious from the cited references.

Specifically, Maples et al. disclose a process in which the pulp is treated in a first acidic bleaching stage and in an oxidative alkaline extraction stage. All or a portion of the filtrate from the first acidic bleaching stage and all or a portion of the filtrate from the oxidative alkaline extraction stage are recycled countercurrently as wash water to at least one brown stock washing stage and to a weak black liquor to form a weak black liquor. which is evaporated. In the preferred embodiments of the Maples' process, these filtrates are recycled as wash water through at least one (preferably all) post oxygen delignification washing stages if such stages are present, brown stock washing stages or a combination thereof (preferably sequentially) and into the recovery stages.

Referring to the Maples reference, the Examiner claims that treatment of brown stock wash water with the bleaching filtrate is done on at least one of the brown stock washers (page 4 of the office Action), and thus the filtrate from one of the brown stock washing stages is treated with an oxidizing agent. Applicants respectfully do not fully

understand this argument. In practice this would mean that the bleaching effluent would contain an oxidizing agent and the liquor which is in the pulp would react with this agent on the washer. However, according to the operation principle of the washers mentioned in claim 2, the liquor in the pulp is displaced by the washing liquid (bleaching effluent). Thus no significant reactions can take place, because the liquor and the effluent do not come into contact with each other very much.

Further, Maples suggest that the bleaching effluents are recycled via the washing stage located after the oxygen delignification stage. Then the filtrate obtained from this washer is already oxidized. Further, in order to have any oxidizing ability the filtrate from a bleaching stage should contain some oxidizing chemical. This is not suggested or taught by Maples, and applicants' understanding is that the bleaching effluents in the Maples process do not contain such chemicals -- not at least in significant and sufficient amounts.

On page 7 of the Office Action, the Examiner rejects claim 1 over Smook in view of Brahmbhatt. Smook discloses a well-known oxygen delignification stage in Fig. 11-18 on page 176. Filtrates from a twin roll press and post-oxygen washing are combined in a tank and used for brown stock washing. Brahmbhatt describes (col. 1) that the chemicals removed from the pulp during the brown stock washing process will be recycled, but there is still some residue to be discharged. These residues can cause environmental harm. In a smaller mill, the chemicals may not be recycled at all, because it may not be economical to do so, and thus the discharge of chemicals from a smaller mill may pose even greater environmental risk.

Thus, the residues of the chemicals used in paper making must be properly treated before they are discharged into rivers or streams. Brahmbhatt suggests that the effluent from the brown stock washing is treated with oxygen. In column 4, line 17-, it is described that the brown stock washing unit includes effluent line 35. Oxygen source 36 supplies oxygen to effluent line 35. This embodiment has the advantage that the oxygen is also used to treat the effluent, thereby reducing the toxicity of the effluent. The basic principle of the method described in said publication is not to prevent organic

loading from entering the oxygen stage, but to decrease the load of the effluents from the brown stock washing. Thus, Brahmbhatt adds oxygen to the effluent which will not be used at the pulp mill. Instead, it is discharged. The Brahmbhatt reference does not teach or suggest adding oxygen to a filtrate which will be used as a washing liquid. The object of Brahmbhatt is to decrease the amount of unwanted effluent from the pulp mill (col. 1, line 65-col. 2, line 26). One primary object of the present invention is to make the oxygen stage more efficient.

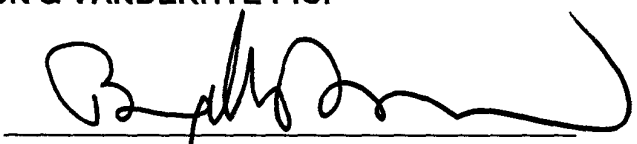
Marcucci merely discloses typical operating conditions for oxygen delignification. No suggestion or contemplation of the present invention can be discerned and, as such, its combination with Smook would not render the present invention obvious.

Therefore, the present invention would not have been obvious even if the secondary references are combined with Maples et al.

In view of the amendments and remarks presented herewith, it is suggested that the present invention is patentably distinguishable over all applied references of record. As such, early receipt of the Official Allowance Notice is solicited.

Respectfully submitted,

NIXON & VANDERHYE P.C.

By: 

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APPENDIX I

Marked-Up Version of Specification Paragraph(s) Pursuant to 37 CFR §1.121(b)

Please change the paragraphs on Page 1, lines 1-15 to read as follows:

METHOD AND APPARATUS FOR TREATING PULP

FIELD OF INVENTION

The present invention relates to a method of and apparatus for treating chemical pulp to optimize the consumption of bleaching chemicals and improve the quality of the pulp. Especially the invention relates to a method and an apparatus, by means of which filtrate obtained from a suitable washing stage of brown stock preferably produced by an alkaline cooking process is treated with an oxidizing chemical prior to the oxygen stage following brown stock washing.

BACKGROUND AND SUMMARY OF INVENTION

In the oxygen stage carried out in medium consistency range, the amount of filtrate per one kg of pulp is 6 – 9 kg, and thus the properties of the filtrate have an essential effect on reactions which the pulp is subjected to in the oxygen stage, as also in the bleaching later on. So, the properties of the filtrate surrounding the pulp may have a significant effect on the chemical treatments carried out on pulp and also the disadvantageous reactions that the pulp is exposed to.

Please change the paragraphs on page 9, line18 though page 10, line 2 to read as follows:

BRIEF DESCRIPTION OF THE DRAWINGS

In the following, the method and apparatus according to the invention are described in more detail with reference to the appended figures, of which

Fig. 1 is a schematic illustration of a prior art method,

Fig. 2 illustrates a pulp treatment method according to a preferred embodiment of the invention, and

Fig. 3 illustrates a pulp treatment method according to a second preferred embodiment of the invention.

DETAILED DESCRIPTION OF THE INVENTION

Fig. 1 is a schematic illustration of a prior art method of treating/bleaching pulp, which method is more precisely described in FI patent application 961856. The pulp is typically kraft pulp, and the consistency thereof in pipe line 10 is typically about 6 – 18%. The pulp may alternatively be treated first in one or several first bleaching stage/s 11 typically using chlorine-free bleaching chemical, preferably oxygen, and after that the pulp is washed in a first wash 12, wherein a first washing liquid is fed via feeding conduit 13, and the filtrate is discharged from the wash 12 via pipe line 14. Filtrate flowing in pipe line 14 may be used in earlier washing stages, or it may be treated and used as make-up liquid in other parts of the bleaching plant or pulp mill or treated in other ways.

APPENDIX II

Marked-Up Version of Amended Claims Pursuant to 37 CFR §1.121(c)

CLAIMS

1. (Amended) Method of treating chemical pulp comprising at least cooking cellulose fibrous material, washing the cooked pulp in several stages comprising successively at least a first washing stage and a second washing stage, and delignificating/bleaching~~washing~~ the washed pulp in an oxygen stage following the washing of the pulp, ~~characterized in that~~ wherein at least part of the filtrate of the second ~~some~~ washing stage preceding the oxygen stage ~~washing of the pulp~~ is recycled countercurrently and treated with an oxidizing chemical before said filtrate or part of it is used as washing liquid in the first washing stage ~~a wash preceding the wash prior to said oxygen stage~~ in order to decrease or prevent the reactions between the oxygen and some cook-originating organic material in the presence of the pulp.

2. (Amended) Method according to claim 1, ~~characterized in that~~ wherein at least part of the washing liquid used in the second washing stage ~~wash preceding the oxygen stage~~ is filtrate obtained from the washer following the oxygen stage.

3. (Amended) Method according to claim 1, ~~characterized in that~~ wherein the washing preceding the oxygen stage is performed by means of a suction drum filter, a diffuser, a belt washer, a multi-stage drum filter or a press.

4. (Amended) Method according to claim 1 ~~or 2~~, ~~characterized in that~~ wherein only ~~the~~ a part of the filtrate that is being used as washing liquid in the first stage is treated with an oxidizing chemical.

5. (Amended) Method according to claim 1, ~~characterized in that~~ wherein the oxidizing chemical is oxygen or hydrogen peroxide or a derivative thereof.

6. (Amended) Method according to claim 1, ~~characterized in that~~ wherein the washing apparatus is a multi-stage drum filter or several drum filters connected in series.

7. (Amended) Method according to claim ~~1 and~~ 6, ~~characterized in that~~ wherein said filtrate is obtained from a washing stage of said multi-stage drum filter and treated with an oxidizing chemical before it is returned back to another washing stage of said multi-stage drum filter to be used as washing liquid.

8. (Amended) Method according to claim 3, ~~characterized in that~~ wherein the washing apparatus is a combination of said devices or a series connection of a said device.

9. (Amended) Method according to claim 8, ~~characterized in that~~ wherein said filtrate is obtained from a filtrate tank of said series connection and returned as washing liquid to a said washing device.

10. (Amended) Method according to claim 1, ~~characterized in that~~ wherein said at least part of the filtrate of the second washing device preceding the oxygen stage is led after the washer into chemical mixing, after which the filtrate-chemical mixture is allowed a sufficient retention time after which the oxidized filtrate is led to the first ~~a preceding~~ washer as washing liquid.

11. (Amended) Method according to claim 10, ~~characterized in that~~ wherein the chemical to be mixed is gaseous, whereby after a certain retention time said filtrate-chemical mixture is led to gas-separation prior to leading the filtrate to the first ~~a preceding~~ washer as washing liquid.

12. (Amended) Method according to claim 11, ~~characterized in that~~ wherein said gas-separation is effected in an open container, wherefrom the filtrate is pumped to the first ~~a preceding~~ washer~~washing device~~.

13. (Amended) Method according to claim 11, ~~characterized in that~~ wherein said gas-separation is effected by means of a discharging device, wherefrom the filtrate is led directly to the first washer ~~a washing device~~ as washing liquid.

14. (Amended) Method according to claim 1, ~~characterized in that~~ wherein after the washing effected with oxidized filtrate, the pulp is led to an oxygen stage having a pH more than 7.5, a pressure of 1 – 17 bar (abs.), a temperature between 75 – 120 °C and treatment time between 0.5 – 120 minutes.

15. (Amended) Method according to claim 14, ~~characterized in that~~ wherein oxygen in the amount of 1 – 50 kg/ADT pulp and alkali in the amount of 1 – 60 kg/ADT pulp is fed into said oxygen stage.

16. (Amended) Method according to claim 14 ~~or 15~~, ~~characterized in that~~ wherein said oxygen stage comprises one or several steps, whereby the steps are counted according to the mixing and chemical dosing.

27. (Amended) Apparatus for treating chemical pulp, which apparatus comprises at least a digester ~~(100)~~ for cellulose fibrous material, ~~so-called~~ brown stock washing devices ~~(102)~~, devices ~~(110)~~ following the wash ~~(102)~~ of the pulp for delignifying/bleaching the pulp in an ~~the~~ oxygen stage and devices ~~(122)~~ for washing the pulp after the oxygen stage ~~(110)~~ and further filtrate lines ~~(FL)~~ for leading washing filtrates countercurrently to preceding washers to be used as washing liquid, ~~characterized in that~~ wherein the filtrate line ~~(FL)~~ preceding the oxygen stage is provided with devices ~~(124, 126, 128, 130)~~ for treating the filtrate flowing in that part of the line with oxidizing chemical.

28. (Amended) Apparatus according to claim 27, ~~characterized in that~~ wherein said oxidizing devices ~~(124, 126, 128, 130)~~ are arranged in a filtrate ~~washing water~~ line ~~(FL)~~ located between the washer ~~(108)~~ just prior to the oxygen stage ~~(110)~~ and the washer ~~(1022)~~ preceding said washer ~~(108)~~.

29. (Amended) Apparatus according to claim 27, ~~characterized in that~~ wherein said oxidizing devices comprise at least a mixer ~~(126)~~.

30. (Amended) Apparatus according to claim 29, ~~characterized in that~~ wherein the mixer used is a filtrate pump ~~(122)~~ or a mixer ~~(126)~~ arranged in the filtrate line ~~(FL)~~ for that special purpose.

31. (Amended) Apparatus according to claim 27, ~~characterized in that~~ wherein the apparatus further comprises after the mixer ~~(126)~~ a reaction vessel ~~(128)~~ or flow pipe, by means of which a sufficient reaction time is effected for the filtrate and the chemical.

32. (Amended) Apparatus according to claim 27 and 29, ~~characterized in that~~ wherein when using a gaseous chemical, in the filtrate line after the mixer ~~(126)~~ there is arranged a separator ~~(130)~~ for excess non-reacted gas.

33. (Apparatus) Apparatus according to claim 32, ~~characterized in that~~ wherein said gas-separator ~~(130)~~ is connected to the filtrate tank wherein the separated gas and foam possibly separated with it are led.

34. (Amended) Apparatus according to claim 27, ~~characterized in that~~ wherein the filtrate system preceding the oxygen stage ~~(110)~~ comprises at least one pressurized reaction vessel.

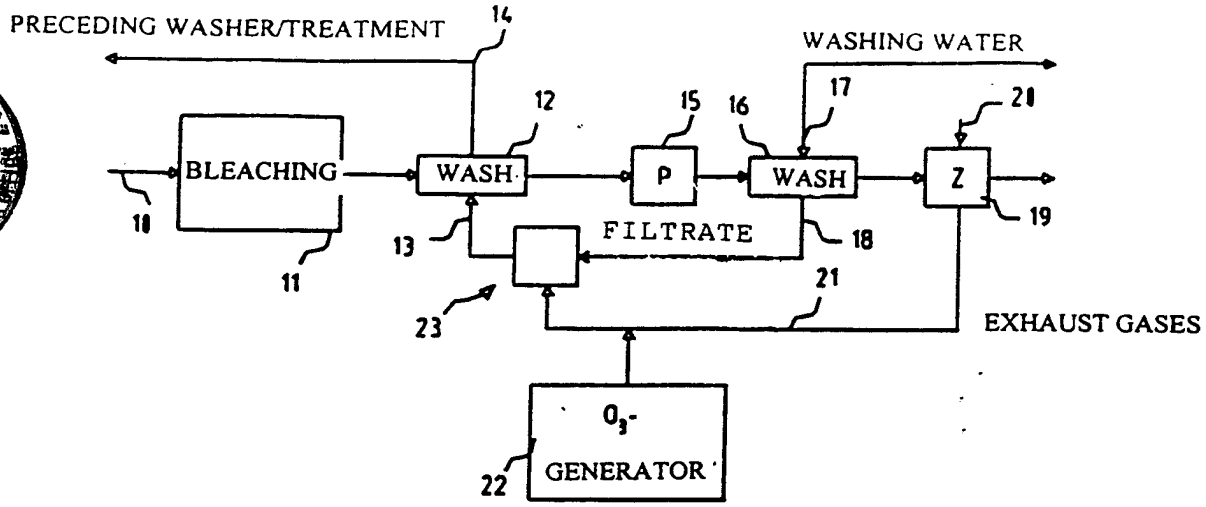

Fig. 1 (Prior Art)

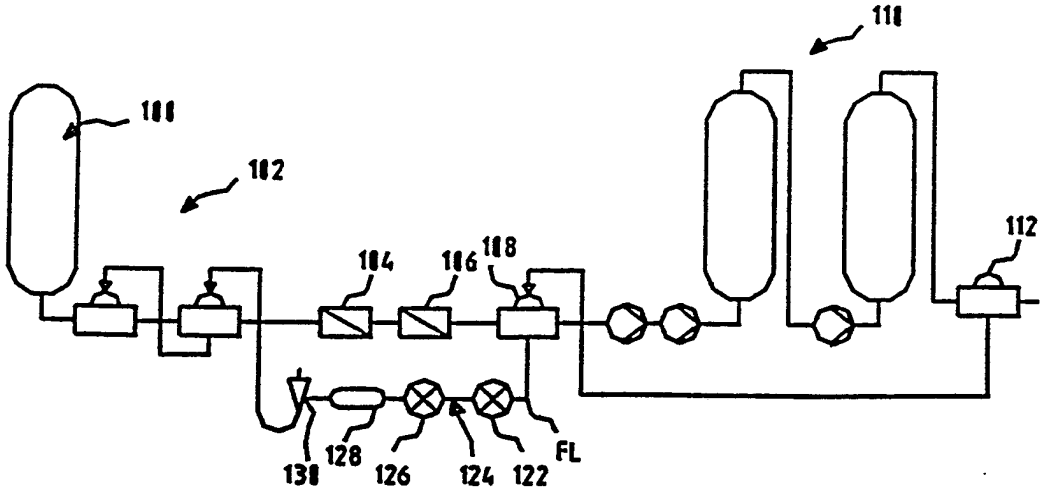

Fig. 2

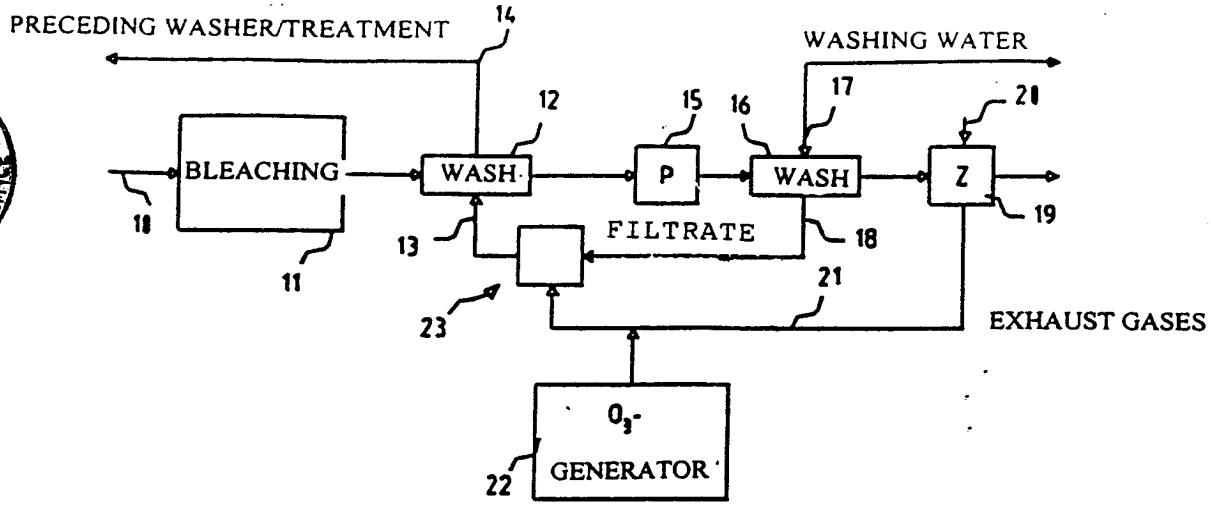

Fig. 1 (Prior Art)

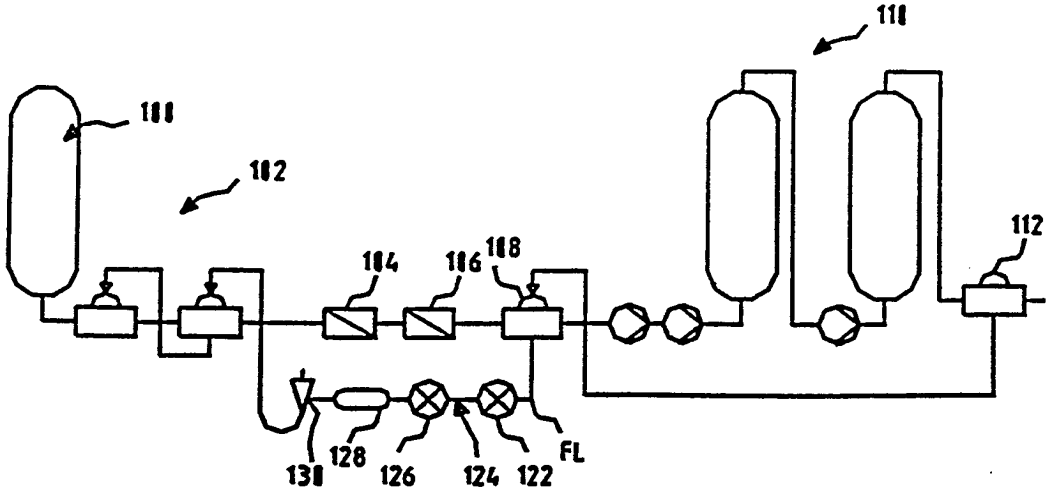

Fig. 2